PHYSICS (9TH) – ENGLISH MEDIUM

Chapter 1: PHYSICAL QUANTITIES AND MEASUREMENTS

Question 1: Define Science?

The word science is derived from a Latin word "Scientia" which means to study natural facts in true meanings or "knowledge". Science is a knowledge which is obtained by the observations and experiments.

Question 2: Define Physics? Write branches of Physics.

Physics is that branch of science which deals with the properties of matter and energy and mutual interaction between them. The laws of physics help us in understanding nature and its behavior.

Branches of physics:

1) Mechanics (2)Optics (3)Sound (4)Nuclear physics (5)Electro-magnetism (6)Geo-physics (7)Atomic physics

Question 3: Write the advantages of physics in everyday life.

Physics has made our lives easier, advanced and comfortable.

1) In modern era technologies like cars, computers, mobile phones, aero-planes, vacuum cleaners, washing machines and all things surrounding us are only because of physics.
2) Laws of physics have helped us a lot in fighting with increasing demand of energy and fuels.
3) Laws of physics have made telecommunication sources so much fast. So, we can make connection at any place.

Question 4: What are the basic principles of physics in car and refrigerator?

Car is based on mechanics and Refrigerator is based on thermodynamics.

Question 5: Define mechanics?

It is that branch of physics which deals with effects of motion of the bodies and its causes. Mechanics is divided into Kinematics and Dynamics.

Question 6: Define plasma and geo physics?

Plasma physics: It is that branch of physics which deals with production of ionic state of matter and its properties. Plasma is the fourth State of matter.

Geo-physics: It is that branch of physics which deals with internal structure of the earth and other geological phenomenon e.g. coming of flood, gales and earth quakes etc.

Question 7: Define electro-magnetism?

It is that branch of physics which deals with moving or stationary charges, their effects and their relationships with magnetism.

Question 8: Define atomic and nuclear physics?

Atomic physics: It is that branch of physics in which we study structure of the atom and its properties.

Nuclear physics: It is that branch of physics which deals with nucleus of an atom, its particles and their behavior.

Question 9: Define physical Quantities.

All measureable quantities are called physical quantities e.g. length, mass, temperature, time.

Question 10: What is the difference between base and derived quantities?

Base quantities	Derived quantities
1) Those physical quantities on the basis of which other quantities are expressed. 2) They can be explained independently. 3) The numbers of base quantities are seven. **Examples:** Length, mass, time, Temperature, Electric Current, Amount of Substance, Intensity of light.	1) Those physical quantities which are derived from the base quantities. 2) They cannot be explained independently. 3) There are undefined number of derived quantities. **Examples:** Force, work, power, Torque, Momentum etc.

Question 11: What are base units? Give examples. OR Write names of seven base units.

The Units that describe base quantities are called base units.

Quantities	symbol	Unit	Symbol
Length	L	Meter	m
Mass	M	Kilogram	kg
Time	T	Second	s
Electric current	I	Ampere	A
Temperature	T	Kelvin	K
Intensity of light	L	Candela	Cd
Amount of substance	N	Mole	mol

Question 12: What are derived units? Give examples.

These are the units which are derived from base units. These are derived by multiplying or dividing the base units.

Quantities	symbol	Units
Area	A	m^2
Volume	V	m^3
Force	F	N or $Kgms^{-2}$
Work	W	Nm
Power	P	Watts or Nms^{-1}
Momentum	P	$Kgms^{-1}$
Electric potential	V	Jc^{-1}

Question 13: What is meant by SI units? What role has it played in progress of science?

It is the world-wide system of units which is accepted in the whole world. It has provided a commonly accepted system of units due to which:

1) Standard units are used for measurements and comparison.
2) A big ease is introduced in science, business and exchange of education.

Question 14: From which quantities work and volume are derived?

According to the formula of the work:

$W=Fd=ma\ (d)=m\ (v/t)\ d=m\ (d/t^2)\ d$

$W=md^2/t^2$

So, work is derived from mass, length and time.

Now according to the volume formula,

$V=LxWxH=m^3$

So, volume is derived from multiples of length.

Question 15: What are prefixes?

Those words or letters which are used before the SI units are known as the prefixes.

Examples: Kilo (10^3), milli (10^{-3}), Mega (10^6), Micro (10^{-6})

Question 16: What is meant by the scientific notation? What is the importance of writing the physical quantities in scientific notation?

To write the numbers in powers of ten or prefixes is known as scientific notation. Scientific notation is also known as standard form.

Principle: The principle to write the numbers in terms of scientific notation is that the decimal is placed after first non-zero digit.

Example: 6400Km can be written as 6.4×10^3km.

0.00045 s can be written as 4.5×10^{-4} s.

Importance:

Its importance is that it saves from writing and interpreting large number of zeroes.

Question 17: Write in scientific notation: 100.8s, 210.0g and 0.00580km.

1.008×10^3s, 2.100×10^2g, 5.80×10^{-3} km

Question 18: Write in standard form: 384000000m and 0.00045.

3.84×10^8m, 4.5×10^{-4}

Question 19: Write names of four measuring instruments.

The names of four measuring instruments are Meter rod, Measuring tape, vernier caliper and screw gauge**.**

Question 20: Explain the use of meter rod?

It is used for measuring length or distance between two points. Meter rod is 100cm long and its least count is 1mm.

Question 21: What is a least count? Write least count of the meter rod.

The minimum measurement that an instrument can make is known as its least count.

The minimum division on the meter rod is its least count. Its value is 1mm or 0.1 cm.

Question 22: How many divisions are there on vernier caliper?

The scale of the vernier caliper which can move is known as vernier scale, it helps to determine the least count of the vernier caliper. There are 10 divisions on the vernier scale.

Question 23: What is meant by vernier constant?

The minimum measurement that can be made by using vernier caliper is known as vernier constant or its least count.

Formula:

L.C = smallest reading on main scale/number of vernier scale readings=1/10

L.C = 0.1 mm = 0.01 cm

Question 24: Why the zero error is so much important for a measuring device?

There are always possibilities of some errors in any reading. To get a correct reading, we always have to calculate the zero error first so that correct value can be gained and possibilities of error can be reduced.

Question 25: What is meant by zero error and zero correction? OR What do you know about the zero error of a measuring device?

Zero error: The minimum error that a device can make is known as the zero error.

Zero can be positive or negative.

Z.E=n x L.C

Where “n” is the coincident division whose value can be 1-10.

Zero correction: To minimize the possibilities of error in any reading is known as zero correction.

To do so, we have to add or subtract the zero error in the measured value.

Z.C=Z.E + measured value OR

Z.C= Z.E- measured value.

Question 26: What is difference between positive and negative zero error?

Positive Zero Error	Negative Zero Error
Positive zero error means that instrument will show reading greater than actual value.	Negative zero error means that instrument will show reading lesser than actual value.

Question 27: What is screw gauge? When its zero error will be positive?

An instrument which can take accurate measurements upto 100^{th} part of millimeter is called screw gauge. When the zero of circular scale is behind the index line then zero error is positive.

Question 28: What is meant by pitch of screw gauge?

When the thimble has one complete rotation, the number of divisions it covers on the main scale is known as pitch of screw gauge.

Formula: Pitch=number of divisions on circular scale x L.C=1mm

Question 29: What is meant by least count of screw gauge? Write its value.

Minimum accurate measurement which can be taken using screw gauge is called least count of screw gauge. Its value is 0.001mm.

Question 30: A screw gauge has 50 divisions on its circular scale and has pitch of 0.5mm.Find its L.C

Given data: no. of divisions on circular scale =n=50

Pitch=0.5mm

Required: **Least count=L.C=?**

Solution **L.C=** $\frac{pitch}{n}$

$$L.C = \frac{0.5}{50}$$
$$L.C = 0.01mm$$

Question 31: Why the reading taken by screw gauge is considered to be more accurate than the reading taken by vernier caliper?

As we know that the least count and correctness of a reading are inversely proportional to each other. As the least count of the vernier caliper is 0.1 mm. It can read upto $1/10^{th}$of a millimeter while the least count of the screw gauge is 0.01mm which tells that screw gauge can read upto $1/100^{th}$ of a millimeter. So, we say that readings taken by screw gauge are more accurate than those by vernier caliper.

Question 32: What is the use of physical balance in physics?

It is used to measure different types of masses in laboratory. Physical balance is made of a beam and a fulcrum which is placed at the centre of the beam.

Question 33: What is the purpose of balancing screws in physical balance?

By using these screws, one can point the needle at 0 position which express that the beam and platform is balanced.

Question 34: What is difference between the physical and electronic balance?

Physical balance	Electronic balance
1) We get an analogue reading.	1) We get a digital reading.
2) It can measure the change of about 10mg	2) It can express a change of 1mg.
3) Its least count is 0.01g	3) Its least count is 0.001g
4) It is less sensitive.	4) It is more sensitive.
5) It has a hook, plumb line, beam, pointer and strip.	5) It consist of glass case and a pan.
6) It has relatively more possibility of error.	6) It measures more accurate value.

Question 35: What is the difference between digital and mechanical stop watch?

Mechanical stop watch	Digital stop watch
1) It gives us an analogue reading.	1) It gives us a digital reading.
2) It has a knob for key purposes.	2) There is no knob.
3) It can measures a duration of 1/10th of second.	3) It can measures upto 1/100th of a second.
4) Its least count is 0.1s	4) Its least count is 0.01s.
5) It is less sensitive.	5) It is more sensitive.
6) It has relatively greater possibility of error.	6) It has relatively less possibility of error.

Question 36: Why we need to measure the small duration of the time?

In Physics, there are many physical quantities which are related to time. For example, motion, velocity, acceleration, momentum and power etc. To measure all these quantities accurately, sometimes, we have to measure the small duration of time.

Question 37: How is digital stop watch used?
Procedure to use a digital stop watch:

1) First of all, press start button. Watch will start.
2) When the same button is pressed again, the watch stops.
3) Time which is shown on the screen of stop watch is actually the time duration between start and stop of the digital stop watch.
4) To reset the watch, press the reset button.

Digital stop watch has least count of 0.01 s.

Question 38: What are the uses of measuring cylinders?

These are used for measuring the volume of liquids and small bodies. It is a graduated cylinder of transparent plastic or glass. This cylinder can measure 100ml-2500ml.

Question 39: How we can measure the volume of irregular shaped solid?

The volume of an irregular shaped solid can be determined using measuring cylinder.

Procedure: Take some water in graduated measuring cylinder and note the volume V_1 of water in cylinder. Tie the irregular shaped solid with a thread. Lower the solid into cylinder till it is fully immersed in water, the water level in cylinder will rise. Note the volume V_2.Volume of the solid will be V_2-V_1.

Question 40: What are significant figures in any measurement?

In any measurement, all accurately known digits and the first doubtful digit is known as significant figures.

For example, 210.0 has 4 significant figures and 0.00580 has 3 significant figures.

Question 41: Write important rules for finding significant figures?

1) Non- zero digits are always significant.
2) Zeros between two significant digits are always significant.
3) In decimal, the last zero at the right side of the reading is also significant.
4) Zeros written on the left side for purpose for spacing point are not significant.

Question 42: What is the relation between the correctness of measured value and the significant figures?

In any measurement, all accurately known digits and the first doubtful digit is known as significant figures. More the significant figure, more the reading is correct. They have direct relation to each other.

For example, Volume of a cylinder is measured by two different instruments. One gives $1.345m^3$ and other gives $1.34m^3$. First reading has 4 significant while other has 3.So, the first reading is more suitable and correct.

Question 43: Round off 1.35 and 1.45.

1.4, 1.4

Question 44: Express your age in terms of seconds?

Given age (days in 1 year × hours in one day × minutes in one hour × seconds in 1 minutes)

=15× (365×24×60×60)

=473040000 sec

Question 45: Express age of 14 years in seconds.

Given age (days in 1 year × hours in one day × minutes in one hour × seconds in 1 minutes)

=14× (365×24×60×60)

=414,504,000 sec

Question 46: Express age of 16 years in seconds.

Given age (days in 1 year × hours in one day × minutes in one hour × seconds in 1 minutes)

=16× (365×24×60×60)

=504,576,000sec

CHAPTER 2: KINEMATICS

Question 1: What is meant by Kinematics?

It is that branch of mechanics in which we study the motion of the body without describing causes of motion.
Kinematics covers types of motion, scalars and vector quantities, equations of motion and terms related to motion e.g. position, displacement, distance, speed, velocity, acceleration and graphical analysis of motion.

Question 2: Define rest and motion?

Rest: If a body does not change its position with respect to its surroundings, the body is said to be in state of rest.

1) A book lying on the table is at rest.
2) A bus passenger with respect to the other passengers is stationary or in the state of rest.

Motion: If a body changes its position with respect to its surroundings, the body is said to be in state of motion.

1) Flying birds.
2) A bus passenger is in motion with respect to the persons on the roads.

NOTE: rest and motion are relative. They change with a change of reference.

Question 3: Define translatory motion and give examples?

If a body moves along a line without any rotation, then the motion is known as the translatory motion. The line can be a straight or a curved.

There are three types of translatory motion:

1) Linear motion
2) Circular motion
3) Random motion

Examples: People riding in Ferris wheel is an example of the of translatory motion

Question 4: Define linear and random motion?

Linear Motion: Motion of a body along a straight line is known as the linear motion.

1) Car moving on a smooth road.
2) A body falling downward.

Random Motion: Motion of a body in a random way without any order is known as the random motion.

1) Motion of the insects
2) Motion of the smoke particles.

Question 5: What is the difference between the circular and vibratory motion?

Circular motion: When a body moves in a circular path, the motion is known as the circular motion.

1) Motion of the sun in its orbit
2) Motion of the moon around the earth.
3) Toy train moving along circular track

Vibratory motion: When a body moves to and fro about its mean position, the motion is known as the vibratory motion.

1) Motion of the clock-pendulum.
2) Motion of the children in the see-saw.
3) Motion of children in swing

Question 6: what is rotatory motion and give an example?

When a body moves about its own axis, the motion is known as the rotatory motion.

1) Movement of wheel about its center.
2) Movement of earth about its own axis.
3) Motion of the steering wheel.

Question 7: What is the difference between the scalar and the vector? Give examples.

Scalars: Those physical quantities that can be explained only using their magnitude and unit.

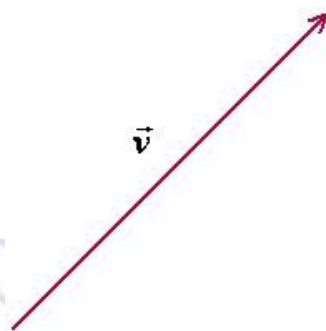
1) Length (2) Mass (3) Speed (4) Work (5) Energy (6) Time

Vectors: Those physical quantities which can be completely explained by their magnitude, unit and direction are called vectors.

1) Displacement (2) Velocity (3) Force (4) Momentum (5) Torque

Question 8: How vector quantities are expressed graphically?

They can be expressed by drawing a line. That line has an arrow head which shows its direction. The length of the line tells us about the magnitude of the vector.

Example:

Question 9: How a vector can be expressed?

A vector can be expressed in following ways:

1) By using bold alphabets.(**F, a, d**)
2) By putting bar on the alphabets e.g. $\bar{F}$, $\bar{a}$, $\bar{d}$
3) By putting an arrow on the alphabets e.g. $\underset{F}{\rightarrow}$, $\underset{a}{\rightarrow}$, $\underset{d}{\rightarrow}$

Question 10: Explain the importance of the vectors everyday life?

1) They tell us about the position of a point or a body.
2) They help us a lot in studying the effects of forces on the objects.
3) Vectors are used for finding the sum of forces.

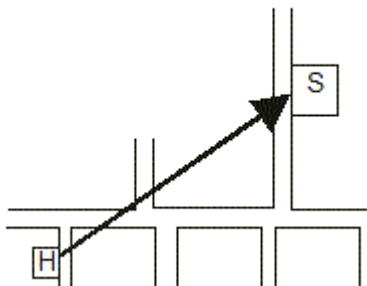
Question 11: why the vectors cannot be added or subtracted like the scalars?

Scalars need only magnitude but vectors require direction too for complete description. Therefore, vectors cannot be added or subtracted as the scalars.

For addition or subtraction of vectors, head to tail rule is used.

Question 12: what is meant by position?

The distance or the direction of a body with respect to a certain point is known as the position of that body or point.

Example:

Question 13: what is the difference between the displacement and distance?

Distance: The total length of path between the two points is known as the distance. It is a scalar quantity and expressed as "S".

Displacement: The shortest distance between two points is known as the displacement. It is a vector quantity and can be expressed as"**d**".

Note: A body can cover distance without any displacement.

Question 14: what is the difference between the speed and the velocity?

Speed: Distance covered in unit time by any body is known as its speed. It is a scalar quantity.

Formula=S/t= distance / time

Velocity: The rate of change of displacement of a body with respect to the time is known as the velocity. It is a vector quantity.

Formula=**d**/t= displacement / time

Question 15: Define terminal velocity.

Free falling objects get uniform velocity, this uniform velocity is termed as terminal velocity. For example a paratrooper gets uniform velocity while landing on ground, it is called terminal velocity.

Question 16: Define acceleration and write its unit?

The rate of change of velocity is known as the acceleration. It is vector quantity.

Formula: a= **v**/t

Unit: unit of acceleration is m/s^2.

Question 17: What is meant by positive or negative acceleration? Or what is retardation?

Positive acceleration: If the velocity of a body is increasing with time then the acceleration is positive. The direction of the acceleration is the same as the direction of motion of body.

Negative acceleration: If the velocity is decreasing with time then the acceleration is negative. Negative acceleration is also known as the retardation. The direction of the acceleration is the opposite as that of the direction of motion of body.

Question 18: Define uniform speed and the uniform velocity?

Uniform speed: If the body covers equal distance in equal intervals of the time, however short the intervals may be, the speed of the body is known as the uniform speed.

Example: motion of the clock needle.

Uniform velocity: If the body covers equal displacement in equal intervals of the time, however short the intervals may be, the velocity of the body is known as the uniform velocity. The acceleration in uniform velocity becomes zero.

Example: The motion of paratrooper

Question 19: Define uniform acceleration and give examples?

If the velocity changes equally in equal intervals of the time, however short the intervals may be then the acceleration of the body is said to be uniform.

Example: The acceleration of a freely falling body is uniform.

Question 20: Can a body have an acceleration while it is moving with a constant speed?

Yes, a body can have an acceleration while it is moving with a constant speed.

Explanation: When a body is moving along a circular path, its speed can be same but its direction is continuously changing. Due to which it has some acceleration.

Question 21: A player covers 100m in 12s. What is its average speed?

Given data: ` **Total time=t=12sec**

Total distance=S=100m

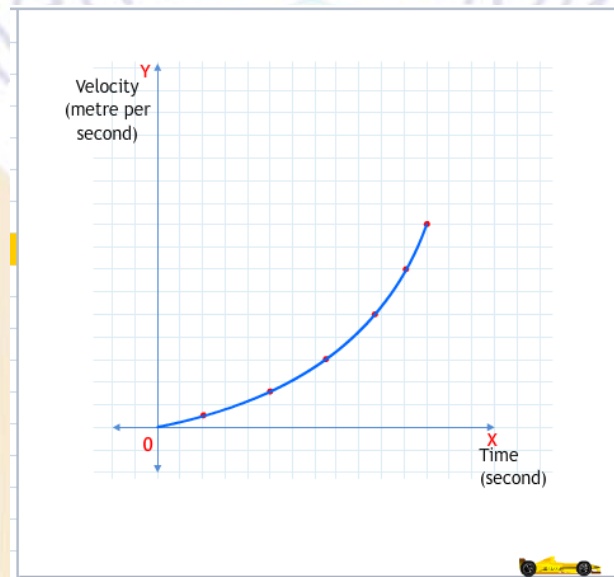
Required: **Average speed=**$V_{ave} = ?$

$$V_{ave} = \frac{distance}{time}$$

$$V_{ave} = \frac{S}{t}$$

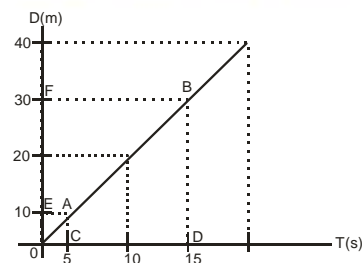
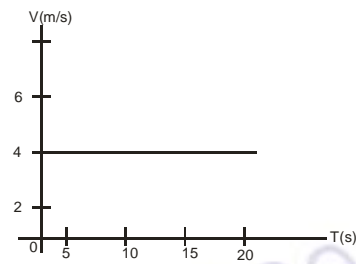
$$V_{ave} = \frac{100}{12}$$

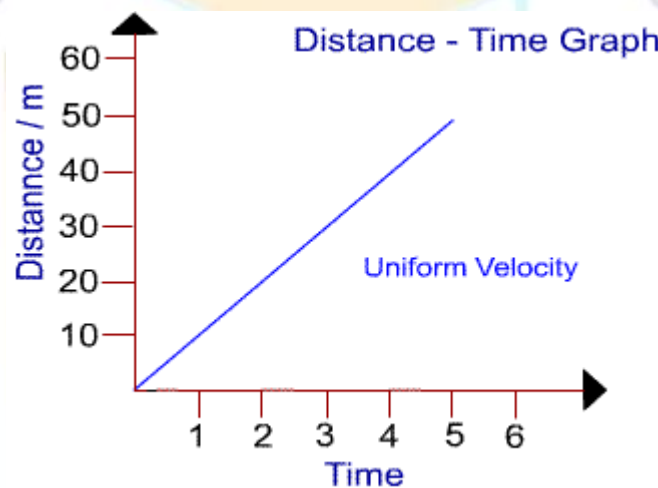
$$V_{ave} = 8.33ms^{-1}$$

Question 22: What is the shape of the speed- time graph when a body is moving with a variable speed?

Question 23: Define variable speed.

If a body covers unequal distance in equal intervals of time then the speed of body is called variable speed.

Question 24: What is the shape of the speed- time graph when a body is moving with a constant speed?

Case1:.If an object covers equal distance in equal intervals of time then its speed will be constant and in this case distance time graph is a straight line.

Case2:. When speed of an object is constant with time then speed-time graph is a horizontal line parallel to time axis.

Question 25: Define distance-time graph.

A pictorial representation of relationship between distance and time is called distance-time graph.

Question 26: What is the shape of the uniform acceleration graph?

ANSWER:

Speed-time showing uniform acceleration

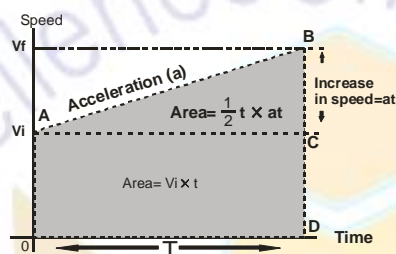
Question 27: Write mathematical expression of first, second and third equation of motion?

Equations of motion for an object moving in a straight line with uniform acceleration are:

1st eq. of motion: $Vf = Vi + at$

2nd eq. of motion: $S = Vit + \frac{1}{2}at^2$

3rd eq. of motion: $2as = Vf^2 - Vi^2$

Question 28: Derive first equation of motion.

Explanation:

Suppose an object is moving along a straight line with uniform acceleration" a". Its initial velocity is V_i and after some time it becomes V_f which is shown by line $\overline{AB}$. The slope of velocity –time graph is acceleration.

Derivation:

Slope of line $\overline{AB}$ =a= $\frac{y_2 - y_1}{x_2 - x_1}$

Graph shows that,

$y_2 = \overline{BD} = V_f$; $y_1 = \overline{OA} = \overline{CD} = V_i$

$X_2 = t$: $x_1 = 0$ So,

$$a = \frac{Vf - Vi}{t - 0}$$

$$a = \frac{Vf - Vi}{t}$$

$at = V_f - V_i$

$V_f = V_i + at$

1st eq. of motion is relation of initial velocity (V_i), final velocity (V_f), acceleration (a) and time (t).

Question 29: A car gains a velocity of 10m/s while moving with a constant acceleration $2ms^{-2}$.What is its velocity after 5s?

Given data: **Acceleration of car=a=$2ms^{-2}$**

Initial velocity =V_i=$10ms^{-1}$

Time=t=5s

Required: **Final Velocity=V_f=?**

Solution: **Using 1st equation of motion**

$V_f=V_i+at$

$V_f=10+(2)(5)$

$V_f=10+10$

$V_f=20\ ms^{-1}$

Question 30: A train moves with a uniform velocity of 36km/h for 10 s. How much total distance will it cover?

Answer: **Given data:** **Velocity of train = V= 36 km/h**

$$=\frac{36\times1000}{3600}ms^{-1}$$

$$V=10ms^{-1}$$

Time=t=10s

Required: Distance=S=?

Solution: Speed=$\frac{distance(covered)}{Time(total)}$

$$V=\frac{S}{t}$$

$$S=Vt$$

$$S=10\times10$$

$$S=100m$$

Question 31: Define gravitational acceleration and write its value?

When a body falls freely under the action of the gravity, its acceleration is known as the gravitational acceleration.

Notation: It can be expressed as"**g**".

Value: Its value is $10ms^{-2}$.

1) For a freely falling body downward, the value of "g" is positive.
2) For a body moving straight upward, the value of "g" is negative.

Question 32: What is the use of LIDAR gun?

LIDAR is a light detecting and speed ranging gun.

Principle: It uses laser pulse to find a series of measurement of the distance of a vehicle. This data is used to find speed.

Question 33: Convert a speed of the $20ms^{-1}$ into km/h?

$$20m/s \rightarrow km/h$$

$$20m/s = 20\left[\frac{\frac{1}{1000}}{\frac{1}{3600}}\right] \qquad \because 1m = \frac{1}{1000}km \qquad \because 1s = \frac{1}{3600}h$$

$$20m/s = 20\left[\frac{1}{1000} \times \frac{3600}{1}\right]$$

$$20m/s = 2(36)$$

$$20m/s = 72Km/h$$

Question 34: Convert a speed of the $10kmh^{-1}$ into m/s?

$$10km/h \rightarrow m/s$$

$$10km/h = \frac{10 \times 1000}{3600} \qquad \because 1km = 1000m \qquad \because 1h = 3600s$$

$$= \frac{100}{36}$$

$$10km/h = 2.77ms^{-1}$$

Question 35: Convert a speed of the 50km/h into m/s?

$$50km/h \rightarrow m/s$$

$$50km/h = \frac{50\times1000}{3600} \qquad \because 1km = 1000m$$

$$= \frac{500}{36} \qquad \because 1h = 3600s$$

$$50km/h = 13.88ms^{-1}$$

Question 36: Convert a speed of the 1km/h into m/s?

$$1km/h \rightarrow m/s$$

$$1km/h = \frac{1\times1000}{3600} \qquad \because 1km = 1000m$$

$$= \frac{10}{36} \qquad \because 1h = 3600s$$

$$1km/h = 0.277ms^{-1}$$

Question 37: Convert a speed of the 72km/h into m/s?

$$72km/h \rightarrow m/s$$

$$72km/h = \frac{72\times1000}{3600} \qquad \because 1km = 1000m$$

$$= \frac{720}{36} \qquad \because 1h = 3600s$$

$$1km/h = 20ms^{-1}$$

Question 38: A train moves at 36km/h speed convert it into m/s.

$$36km/h \rightarrow m/s$$

$$36km/h = \frac{36\times1000}{3600} \qquad \because 1km = 1000m$$

$$= \frac{360}{36} \qquad \because 1h = 3600s$$

$$36km/h = 10ms^{-1}$$